Memorandum

U.S. Department of Transportation
Federal Aviation Administration

Subject: **ACTION: Policy for the Design Approval of Parts Manufacturer Approval (PMA) of Critical and Life-Limited Aircraft Turbine Engine Parts**

Date: **July 16, 1998**

From: **Manager, Engine and Propeller Directorate Aircraft Certification Service**

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INTRODUCTION

As a result of continued involvement in the evaluation of PMA requests on critical and life-limited aircraft turbine engine parts the Engine and Propeller Directorate (EPD) Standards Staff has recognized the need to expand the written PMA policy issued, by this office, on June 29, 1995. The intent of this memorandum is to extend the scope of that policy to address all critical aircraft turbine engine components; and to further establish a uniform approach for Aircraft Certification Offices (ACOs) to evaluate PMA applications for both non-life-limited and life-limited critical aircraft turbine engine parts, such as rotating shafts, disks, load carrying static structures, controls, etc.

This memorandum supersedes "Policy on Parts Manufacturer Approval (PMA) of Life-Limited Aircraft Engine Parts" dated June 29, 1995.

"Policy for Parts Manufacturer Approval (PMA) of Reciprocating Engine Critical, Highly Stressed or Complex Parts or Components," issued April 10, 1997, is still in effect for aircraft reciprocating engine parts.

- Determination of Critical Parts

Federal Aviation Administration (FAA) Order 8110.42, "Parts Manufacturer Approval Procedures," defines the terms life-limited and critical. The definition for life-limited parts is straight forward as related to aircraft turbine engine parts. However, the definition for critical has not been consistently effective in categorizing various engine parts as critical. The EPD Standards Staff is tasked with developing a list of generic critical parts germane to all engines. Until this list is made available, the determination of critical engine parts should be the responsibility of the ACO which issued and has oversight of the original design approval, i.e. the certificating ACO, for the engine(s) on which the PMA Applicant's part is eligible for installation.

Note: For the purpose of this memorandum the use of the word critical will reflect both life-limited and non-life limited critical components.

- The Process

Once a part is determined to be critical, then the PMA application is considered a "significant project" in accordance with the intent of FAA Order 8100.5, "Aircraft Certification Directorate Procedures." The ACO must then notify the EPD Standards Staff by completing and electronically transmitting a Certification Program Notification (CPN). Upon receipt of the CPN a Project Officer will be assigned.

"The FAA Type Certification Process" guide dated May 1996, will assist in the successful coordination and management of the PMA approval process in a manner consistent with established practices which identify the roles of the different FAA personnel required to interface in accordance with paragraph 9.c.(2)(f) of Order 8110.42 and; define a process to ensure that the program is handled in a complete and precise manner.

DISCUSSION

- Certification Basis

Order 8110.42 states that, regardless of the method upon which PMA is sought, Identicality or Test and Computations, the applicable airworthiness requirements of the Federal Aviation Regulation (FAR) relevant to the product on which the part is to be installed, must be addressed. For aircraft turbine

engine parts the pertinent airworthiness requirements are defined in either the applicable amendment level of the Civil Aeronautics Manual (CAM) 13 or in 14 CFR part 33 (part 33) of the FAR.

- PMA by Identicality

Approval of aircraft turbine engine replacement parts based on Identicality requires that the Applicant show that the design of the replacement part is identical to the design of the part covered under the Type Certificate (TC), as defined by §21.31. The design of the PMA part is defined by §21.303(c)(3)(i) to include the drawings and specifications, as well as subparagraph (ii) to include information on dimensions, materials, and processes necessary to define the structural strength of the part. For non-critical parts, the data evaluation is usually accomplished by comparing the PMA Applicant's drawings, material and process specifications to the TC holder's corresponding drawings and specifications issued in accordance with §21.31(a) and (b).

For critical aircraft turbine engine parts additional emphasis on the requirements of §21.303 (c)(3)(ii) is necessary. This would obligate the Applicant to submit detailed information on the materials and processes as described by Order 8110.42, paragraphs 8.c. through 8.c.(3). These data should include, but not be limited to all elements of the manufacturing cycle (raw material purchase, material chemistry and grain structure evaluation, fabrication, melt, forging, machining, surface treatments, other material properties, required inspections, etc.) and; any other data required to show identicality to the design of the part covered under the TC as defined in §21.31 (a) through (e). Thus, the Applicant would need to provide appropriate details and compare every aspect of the manufacturing process, from raw material procurement and first article testing, through finished part, to substantiate identicality.

In addition, for life-limited parts, the airworthiness limitation is considered an essential component of the part's design and must be evaluated. To ensure the continued airworthiness of the life-limited part the Applicant must also provide for FAA approval, a Life Management Program. (Reference Order 8110.42 8c.(5) and 8.c.(7))

It is essential that for critical PMA parts approved on the basis of Identicality, without the Engine Original Equipment Manufacturer's (OEM's) support, that no deviation in part design or manufacturing processes be allowed. Hence, the PMA holder's fabrication inspection system must not allow for the acceptance of parts that deviate in any manner from the approved design data. Any change in the PMA certified data will require further FAA review and approval.

-PMA by Test and Computations

Section 21.303(c)(4) requires that if the Applicant cannot substantiate that the design of the PMA part is identical to the design of the part covered by the type certificate, then the Applicant must provide proposed methods of compliance necessary to show that the design of the part meets all the airworthiness requirements of the FARs applicable to the product on which the part is to be installed. Order 8110.42 specifies that "the certification basis for the PMA part is the same as that for the product on which the part is to be installed." For aircraft turbine engine parts, the applicable airworthiness requirements for test and computations would be CAM 13, which defines the civil air regulations, or part 33. Note, however, if it is determined that the PMA part consists of changes that would be considered major (i.e. change in material, change in manufacturing process or specification, change in critical dimensions, etc.) and the EPD Standards Staff determines that the regulations incorporated by reference in the type certificate for the product do not provide adequate standards with respect to the proposed change, the Applicant must comply with the applicable part 33 requirements in effect on the date of the application for PMA (this is in accordance with FAR 21.101(b)).

Order 8110.42 paragraph 8.g. states that the PMA Applicant must furnish data sufficient for the FAA to determine that the Instructions for Continued Airworthiness (ICA) will continue to be valid for the product with the PMA part installed. For non-life-limited critical turbine engine parts the Applicant must also provide a procedure to show that later revisions to those ICA will continue to be valid for the product with the PMA part installed. In this regard the Applicant will need to furnish supplementary ICA if installation of the PMA part results in changes to the validity of the ICA; or the Applicant is unable to provide adequate assurance that future ICA revisions will not be used for the PMA part, before determined valid by the FAA. For all life-limited aircraft turbine engine parts the Applicant must furnish supplementary ICA.

- Life Management Program

It is important for all to understand that the FAA will not ignore lessons learned and will prescribe utilization of advancements in technology that have enabled the Engine OEM's to develop fatigue lifing methodologies that are used to evaluate and ensure the continued airworthiness of life assessed critical parts.

As cited in §21.31 the type design includes the airworthiness limitations section of the ICA which defines the life-limit of a part. Order 8110.42 paragraph 9.c.(2)(d) states that "Irrespective of the method under which an Applicant seeks a PMA, a life-limited part must be substantiated in accordance with paragraph 8.c.(2) and (3). The substantiation must accurately establish the life limits and airworthiness of that part."

For non-life-limited critical parts it is the responsibility of the ACO to ascertain whether or not the Engine OEM's part was life assessed. If the Engine OEM's part has been life assessed then evaluation of the life of the PMA part is required. Thus, irrespective of the method under which an Applicant seeks a PMA, the compliance plan for a life assessed critical PMA part must include a proposed fatigue lifing methodology and test validation plan to be used for the establishment or verification of the initial part life and in support of a continued airworthiness life management program.

Note: For this memorandum a life assessed critical part is a part which has been low cycle fatigue evaluated, i.e. engine mounts, and may or may not have a safe life limit or a mandatory inspection requirement depending upon the results of the life assessment.

-Applicant Resources

It is the responsibility of the Applicant to secure the necessary technical expertise to sufficiently support the design, manufacturing, and continued airworthiness efforts (as outlined above and in Order 8110.42) required for critical PMA parts. It is essential that these resource are validated during the design and production approval phases of the PMA.

CONCLUSION

In summary,

- the determination of criticality of all PMA parts is to be accomplished by the certificating ACO;

- PMA applications for critical parts are to be considered significant projects and will be processed in accordance with "The FAA Type Certification Process" guide;

- the PMA holder's fabrication inspection system must not allow for the acceptance of parts that deviate in any manner from the approved design data for critical PMA parts approved by the method of Identicality, without the Engine OEM's support;

- for all life-limited engine parts the Applicant must furnish supplementary ICA;

- irrespective of the method under which an Applicant seeks a PMA, a proposed fatigue lifing methodology must be provided for all life-limited and life assessed critical parts; and

- it is the responsibility of the Applicant to secure the necessary technical expertise to sufficiently support the design, manufacturing, and continued airworthiness efforts of their PMA part.

These requirements should be conveyed to the Applicant as early as possible in the PMA process to allow the Applicant ample opportunity to define a detailed compliance program.

Original signed by:
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